THE MINOR PLANETS OF THE *TROJAN* GROUP.

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The dates of discovery and approximate mean motions of the four minor planets belonging to this group are as follows:—

Name.	Year of Discovery.	Mean Daily Motion.
(588) *Achilles*	1906	295″.5
(617) *Patroclus*	1906	300 .5
(624) *Hector*	1907	293 .1
(659) *Nestor*	1908	300 .8

The mean motion of the planet *Jupiter* is 299″.1, from which it will be seen that all five bodies travel about the Sun at approximately the same rate. The variation in the distance, asteroid-*Jupiter,* during one revolution is then primarily a function of the eccentricities. In the case of *Hector,* the eccentricity of which is 0.03, this distance is nearly constant. *Achilles* suffers the greatest variation in distance from *Jupiter;* but in no case does this greatly exceed 15 per cent. On this account, the perturbations due to *Jupiter* vary slowly. It is quite probable that the computation of *Jupiter's* disturbing influence may be avoided for one or more oppositions if its attraction is taken into account in the computation of the preliminary orbit. Owing to this near equality of mean motions, and smallness of eccentricity, the configuration, *Jupiter*-Sun-asteroid, remains practically unchanged during the revolution about the Sun. Three of these bodies are in the region 60° in advance of *Jupiter* as seen from the Sun, and one 60° behind. There may be departures as great as 15° to 20° from the equilateral triangle configuration. They nevertheless suggest Laplace's famous solution of this special case in the problem of three bodies.

Laplace proved that, given certain mass ratios and initial velocities, the equilateral triangle configuration would remain unchanged during the revolution of the system about its center of mass. As applied to our solar system, since the mass of the Sun is great as compared with the masses of the planets, this

amounts to a revolution of the equilateral triangle about the vertex at which the Sun is situated.

According to the investigations of Professor E. W. BROWN, the perturbations suffered by the *Trojan* group are of long period—probably 150 years. His researches show that the oscillations may be librational; that is, that the changes in the mean motion may be such as to carry the body from inside to outside (and *vice versa*) of the orbit of *Jupiter.* These oscillations may become large. In extreme cases the body may be carried from one triangle point to the other on the opposite side of the Sun from *Jupiter.* BROWN has also been led to the interesting conclusion that this long-period variation in the mean motions is very nearly independent of the inclinations and eccentricities.

Definitive osculating orbits of these bodies will be of great assistance in the verification of these theoretical considerations. Only one has been computed to date, that of (624) *Hector,* by Professor STRÖMGREN of the University of Copenhagen. The difficulties which he experienced and the great amount of numerical work which he had to perform, led to the investigation of the most suitable methods for the derivation of osculating orbits for the minor planets of this group.

Comparison of cometary orbits computed by many different methods has established the fact that the Laplacean methods yield, almost without exception, more accurate results and involve considerably less numerical work. In addition, when the attraction of a third body is appreciable, that method will yield the most accurate results which takes immediate account of this attraction in the computation of the preliminary orbit. Investigation of the orbits of (624) *Hector* and (588) *Achilles* was undertaken by LEUSCHNER'S method of deriving orbits on the basis of more than one attracting body in order to supply actual numerical verification of these statements.

It has been found in these two cases that an orbit based on the observations of one opposition, and computed by LEUSCHNER'S method of taking immediate account of the perturbations, will represent the observations of the preceding or following opposition, without further perturbations, within a minute of arc. The orbit of (624) *Hector* gave a better representation

after two oppositions than STRÖMGREN's preliminary orbit after one opposition. This orbit was taken up first because it made possible a comparison between the methods in use at the Students' Observatory and those used by Professor STRÖMGREN in the derivation of definitive elements of this asteroid. The orbit of (588) *Achilles* was taken up next. This is nearing completion. It is the plan of the writer to compute definitive orbits of (617) *Patroclus* and (659) *Nestor* as well, so as to afford reliable comparisons in the case of all four asteroids between actual osculating elements and the theoretical orbits based on triangular solutions.

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THE MINOR PLANET 1911 *MT*, (719) *ALBERT*.

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The minor planet 1911 *MT* was discovered on the night of October 3, 1911, by PALISA at Vienna. On the following night a second observation was secured by the discoverer and two others by PECHÜLE at Copenhagen. Further observations were prevented by bad weather and the increasing light of the Moon. The rapid direct motion of the planet had marked it as an object of unusual astronomical interest. Therefore, as soon as the waning light of the Moon permitted, an extensive photographic campaign for its recovery was undertaken. Careful examination of the plates secured in this campaign failed to reveal any trails not identifiable with other planets. If images of *MT* existed on any of these plates, they must be so faint as to require detailed examination for their discovery. The problem of determining an approximate orbit of *MT* to guide astronomers in this detailed examination of their photograph was undertaken at Berkeley by Mr. J. H. PITMAN and the writer.

The determination of even an approximate orbit for 1911 *MT* had been looked upon as rather a hopeless task because of the scantiness of the available observational material. The extreme observations of October 4th were separated by an interval of